

Token Engineering *Community*

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**“Show me the incentive
and I will show you the outcome.”**

-Charlie Munger



“Incentive Machine”

Get people to do stuff
By rewarding with tokens

A Personal Journey of Token Design

Token design practice

Challenges

6. Revenue can.

- How to ensure supplier gets paid up loss ability to get paid in future. "Free riding"
"Privacy"
"Copy or title"

2. How to price?

Friction in pricing → overall price
→ relative impact per dataset

Static	Dynamic dataset	Knowledge flow
<p><u>Strategic</u></p> <ul style="list-style-type: none">- data labeling source- data distribution market <p>→ Stake in belief of <u>data</u></p> <p>- value of dataset <u>decreasing</u></p> <p>- - - - - by data volume</p> <p>→ price affected by reputation</p> <p>- price bid by reputation</p> <p>- reputation of dataset</p> <p>- - - - - reputation</p> <p>- - - - - secretariat</p> <p>- harder for non force entry dataset</p> <p>→ value gained from dataset (U) in <u>past FL</u></p> <p>- by historical (mostly reference range)</p> <p>- data value of network value per dataset</p> <p>- prediction market belief in value of dataset</p> <p>- only a subset</p> <p>- take a price of dataset</p> <p>- - - - -</p>	<p><u>Tools to</u></p> <ul style="list-style-type: none">- address free riding- Data privacy doesn't care- Licensing- data distribution- underwriting- reputation- performance- risk of litigation <p>- only the smart contract can use the data. By default, a hacker does it.</p> <p>- If data set free, you have some private key gets exposed and value is 0.</p> <p>- Data obfuscation, no latent variables in old data (Anonymous)</p> <p>Source: https://www.researchgate.net/publication/351111111</p>	<p>Knowledge flow</p> <ul style="list-style-type: none">- Data privacy- Data distribution- Data volume- Data value- Data reputation- Data performance- Data risk

[illegible][illegible]

Token design practice: the default is to flail. To fail?

Challenges

1. How to ensure supplier gets paid w/o losing ability to get paid in future. "Free riding", "Privacy", "Copy or tithe"

2. Friction in pricing

Static \leftrightarrow Dynamic datasets (game rules)

Signals

- Stake in belief of data
- Value of dataset
- Price asked by market
- Price bid by scientist
- Reputation of dataset
- Supply

Tools to address free riding

- Dynamic dataset
- Dynamic price
- Dynamic reputation
- Dynamic supply

PLM on datasets

Scarcity for w/e of dataset. Data scientists bid on value to use.

Challenges

1. How to ensure supplier gets paid w/o losing ability to get paid in future. "Free riding", "Privacy", "Copy or tithe"

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PLM on datasets

Scarcity for w/e of dataset. Data scientists bid on value to use.

Engagements / Incentives

fix price up-front

reputation (subject to data, scientist)

Shake

model passes visible for data supplier

data visible for scientist

data private - model passes private

Co-owner of \$

Tokenizing Access to Data Returns, Fixed Supply

Tokenizing Access to Data Itself

Multi-level auction, reputation of price

1. \$1000 top 1K bids, hidden price

2. Auction happens

highest bid	lowest bid	price
\$10K	\$1K	now
\$9K	\$1K	in 2 mo
\$8K	\$1K	in 2 mo
\$7K	\$1K	in 3 mo

And: in 6 mos: data is not free

Marketplace for data

1. Supplier sets bid price

2. Top 3 bidders get data

3. Top 3 bidders get data

Realizations:

- 1. Tokenized ecosystems are evolutionary systems.**
- 2. Therefore design \approx evolutionary algorithm design!**

Steps in EA Design

1. **Formulate the problem.** Objectives, constraints, design space.
2. **Try an existing EA solver.** If needed, try different problem formulations or solvers.
3. **Design new solver?**

1. Formulation of optimization problem

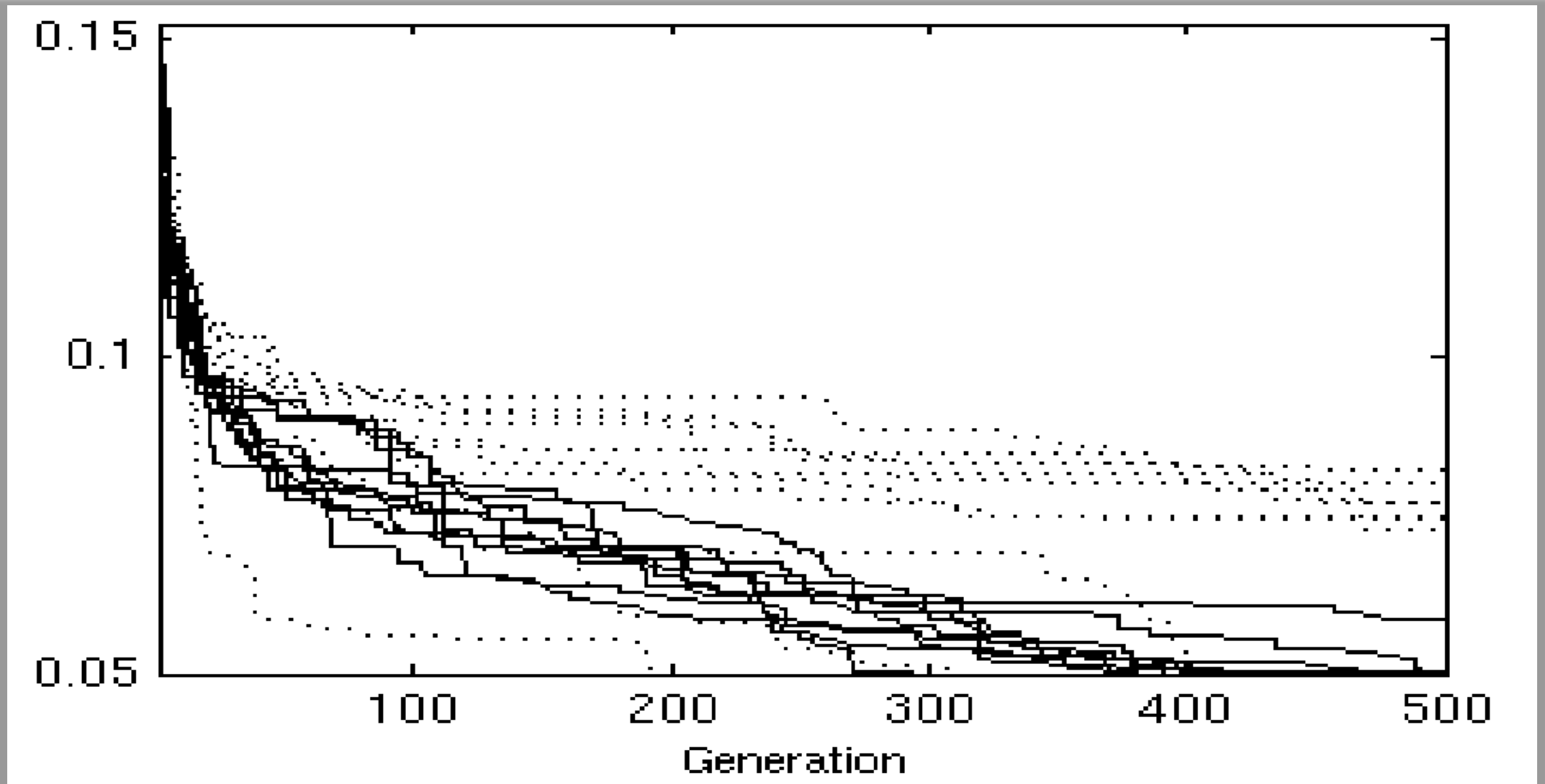
Objectives & constraints in a design space

The algorithm's aim is formulated as a constrained multi-objective optimization problem

$$\begin{aligned} \text{minimize} \quad & f_i(\phi) & i = 1 \dots N_f \\ \text{s.t.} \quad & g_j(\phi) \leq 0 & j = 1 \dots N_g \\ & h_k(\phi) = 0 & k = 1 \dots N_h \\ & \phi \in \Phi \end{aligned} \tag{1}$$

where Φ is the “general” space of possible topologies and sizings. The algorithm traverses Φ to return a Pareto-optimal

2. Try an existing EA solver. Does it converge?



3. Design new EA solver

TABLE II
PROCEDURE SANGRIAOPTIMIZATION()

Inputs: $D, N_a, K, N_L(k)$

Outputs: d^*

1. $N_{gen} = 0; P = \emptyset, P_{all} = \emptyset$
2. while $stop() \neq True$:
3. if $(N_{gen} \% N_a) = 0$:
4. if $|P| < K$:
5. $P_{|P|+1} = \emptyset$
6. $P_0 = \text{SpaceFillIndividuals}(N_L(k), N_D, D)$
7. for $k = 1$ to $|P|$:
8. $P_k = \text{SelectParents}(P_k, P_{k-1}, N_L(k))$
9. $P_{k,j} = \text{UpdateLocalOptState}(P_{k,j}, k), j = 1$ to $|P_k|$
10. $P_{all} = \text{unique}(P_{all} \cup P)$
11. $P_{|P|} = P_{|P|} \cup \text{InnerOptimize}(P_{all}, D, k)$
12. $d^* = d_i$ in P_{all} with highest Y or Cpk
13. $N_{gen} = N_{gen} + 1$
14. return d^*

and all individuals encountered so far in the search, P_{all} .

Lines 2–13 are the generational loop, which repeats until stop

Steps in *Token Ecosystem* Design

1. **Formulate the problem.** Objectives, constraints, design space.
2. **Try an existing building block.** If needed, try different formulations or EA solvers.
3. **Design new building block?**

1. Formulate the Problem: [ex. Ocean]

Who are stakeholders?
What do they want?

Objectives &
constraints

Key stakeholders in Ocean ecosystem

Stakeholder	What value they can provide	What they might get in return
Data/service provider, data custodian, data owner	Data/service (market's supply)	Tokens for making available / providing service
Data/service referrers, curators. Includes exchanges and other application-layer providers.	Data/service (via a provider etc), curation	Tokens for curating
Data/service verifier. Includes resolution of linked proofs on other chains	Data/service (via a provider etc), verification	Tokens for verification
Data/service consumer	Tokens	Data/service (market's demand)
Keepers	Correctly run nodes in network	Tokens for chainkeeping

Obj:

- Maximize supply of relevant data

Constraints = checklist:

- For priced data, is there incentive for supplying more? Referring? Spam prevention?
- For free data, "" ?
- Does the token give higher marginal value to users vs. hodlers?
- Are people incentivized to run keepers?
- Is it simple? Is onboarding low-friction?

2. Try Existing Patterns

1. **Curation**
2. Proofs of human or compute work
3. Identity
4. Reputation
5. Governance / software updates
6. Third-party arbitration
7. ...

2. Try existing patterns: evaluate on objectives & constraints. [Ex Ocean: None passed...]

Key Question	1	2	3	4
For priced data: incentive for supplying more? Referring?	✗	≈	✓	≈
For priced data: good spam prevention?	≈	✓	✓	✓
For free data: incentive for supplying more? Referring?	✗	≈	✗	✓
For free data: good spam prevention?	≈	✓	≈	✓
Does token give higher marginal value to users of the network, vs external investors? Eg Does return on capital increase as stake increases?	✓	✓	✓	✓
Are people incentivized to run keepers?	≈	≈	✓	✓
It simple? Is onboarding low-friction? Where possible, do we use incentives/crypto rather than legal recourse?	✓	✓	≈	≈

3. Try **new** patterns: evaluate on objectives & constraints. [Ex Ocean: pass!]

Key Question	1	2	3	4	5	6
For priced data: incentive for supplying more? Referring?	✗	≈	✓	≈	≈	✓
For priced data: good spam prevention?	≈	✓	✓	✓	✓	✓
For free data: incentive for supplying more? Referring?	✗	≈	✗	✓	✓	✓
For free data: good spam prevention?	≈	✓	≈	✓	≈	✓
Does token give higher marginal value to users of the network, vs external investors? Eg Does return on capital increase as stake increases?	✓	✓	✓	✓	✓	✓
Are people incentivized to run keepers?	≈	≈	✓	✓	✓	✓
It simple? Is onboarding low-friction? Where possible, do we use incentives/crypto rather than legal recourse?	✓	✓	≈	≈	✓	✓

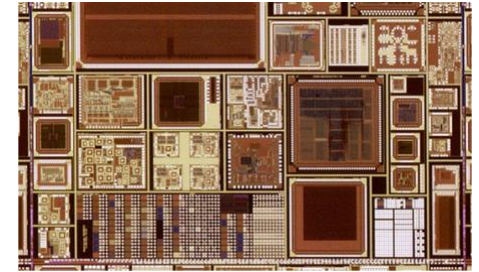
On Tools

Tools

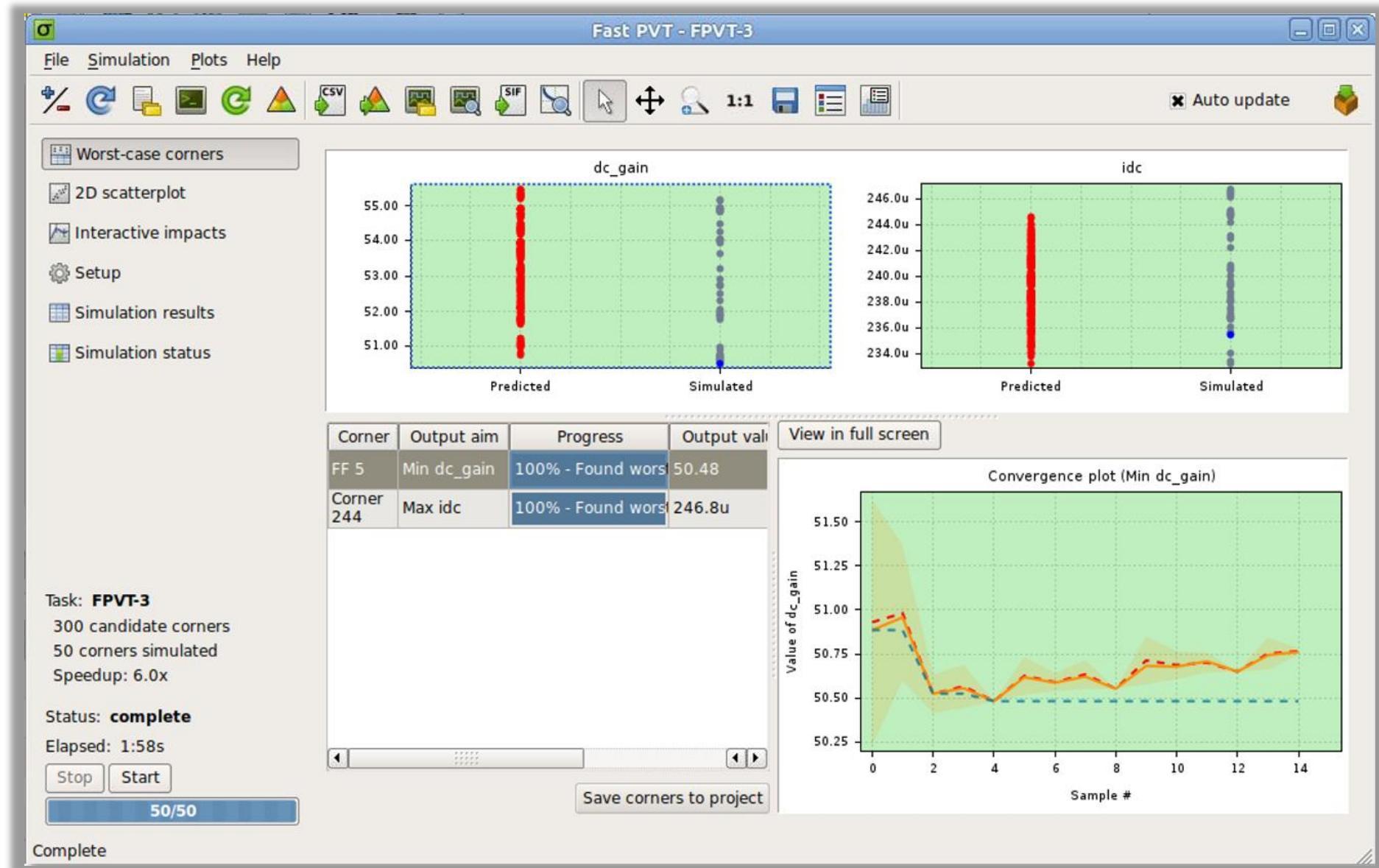
Q: How do we design circuits?
(\$50M+ at stake)

A: **CAD Tools** for

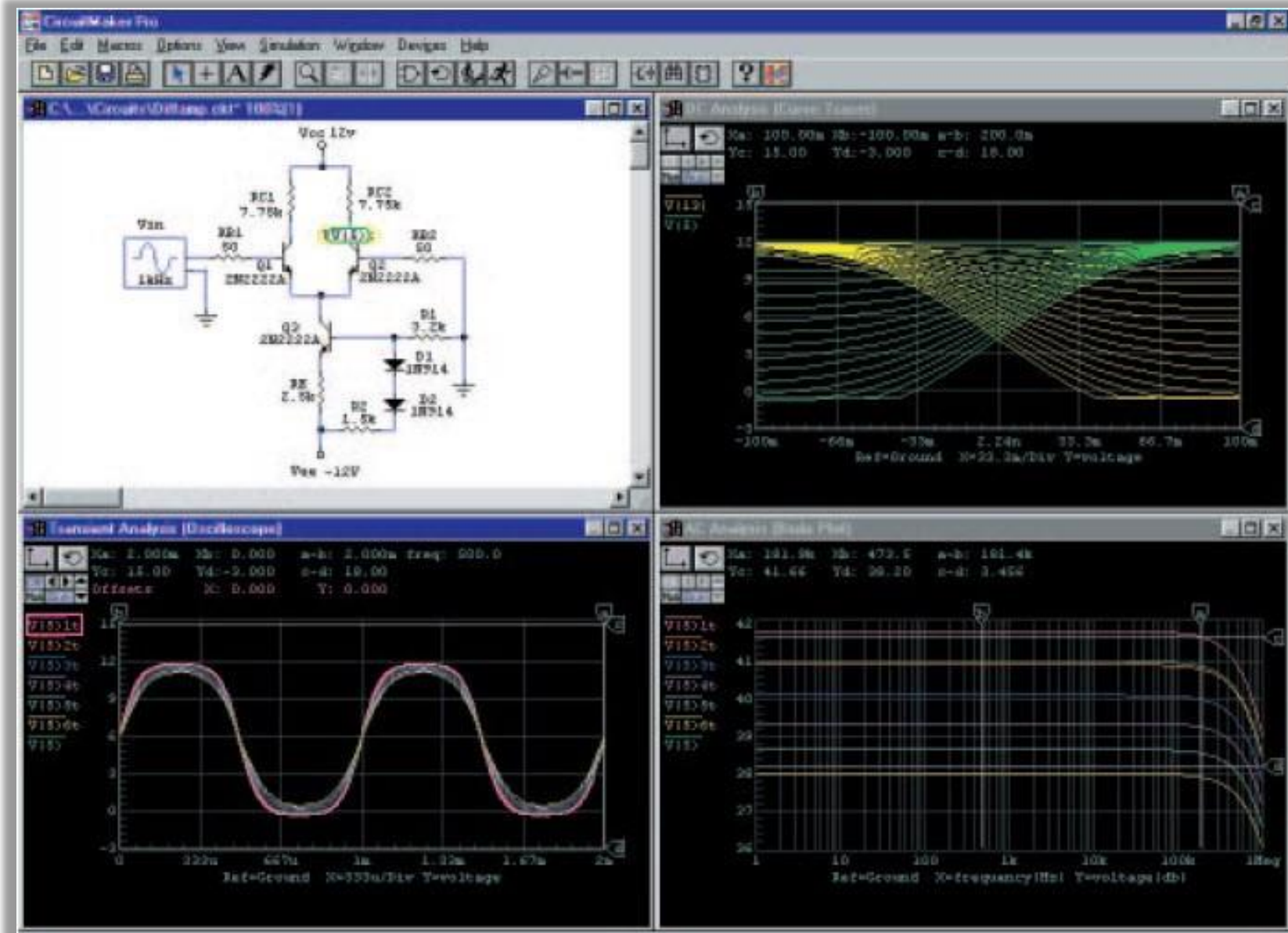
- Simulation,
- Verification, and
- Design



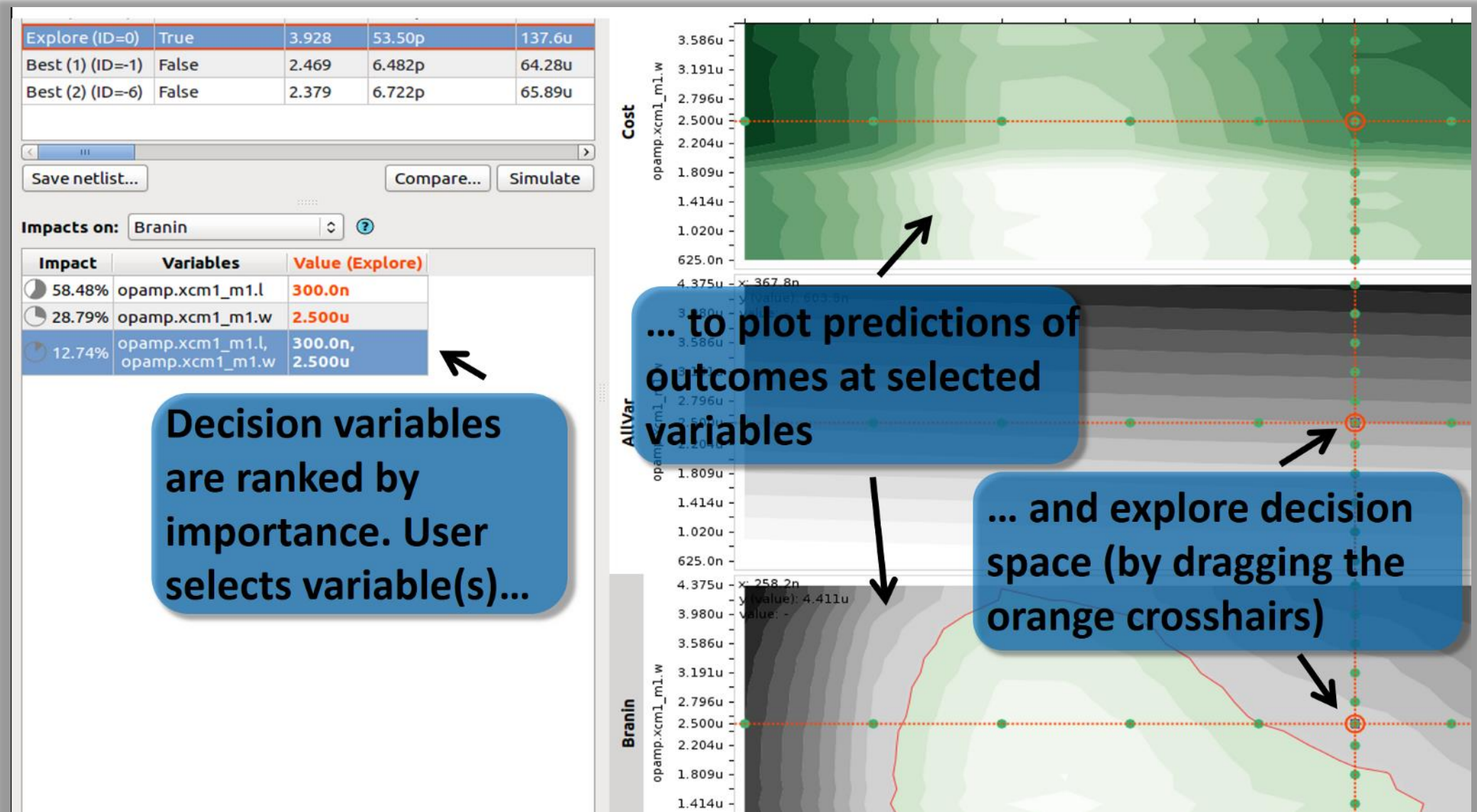
Verification across Worst-Case Conditions



Simulation of Circuit Dynamics



Interactive Design / Exploration



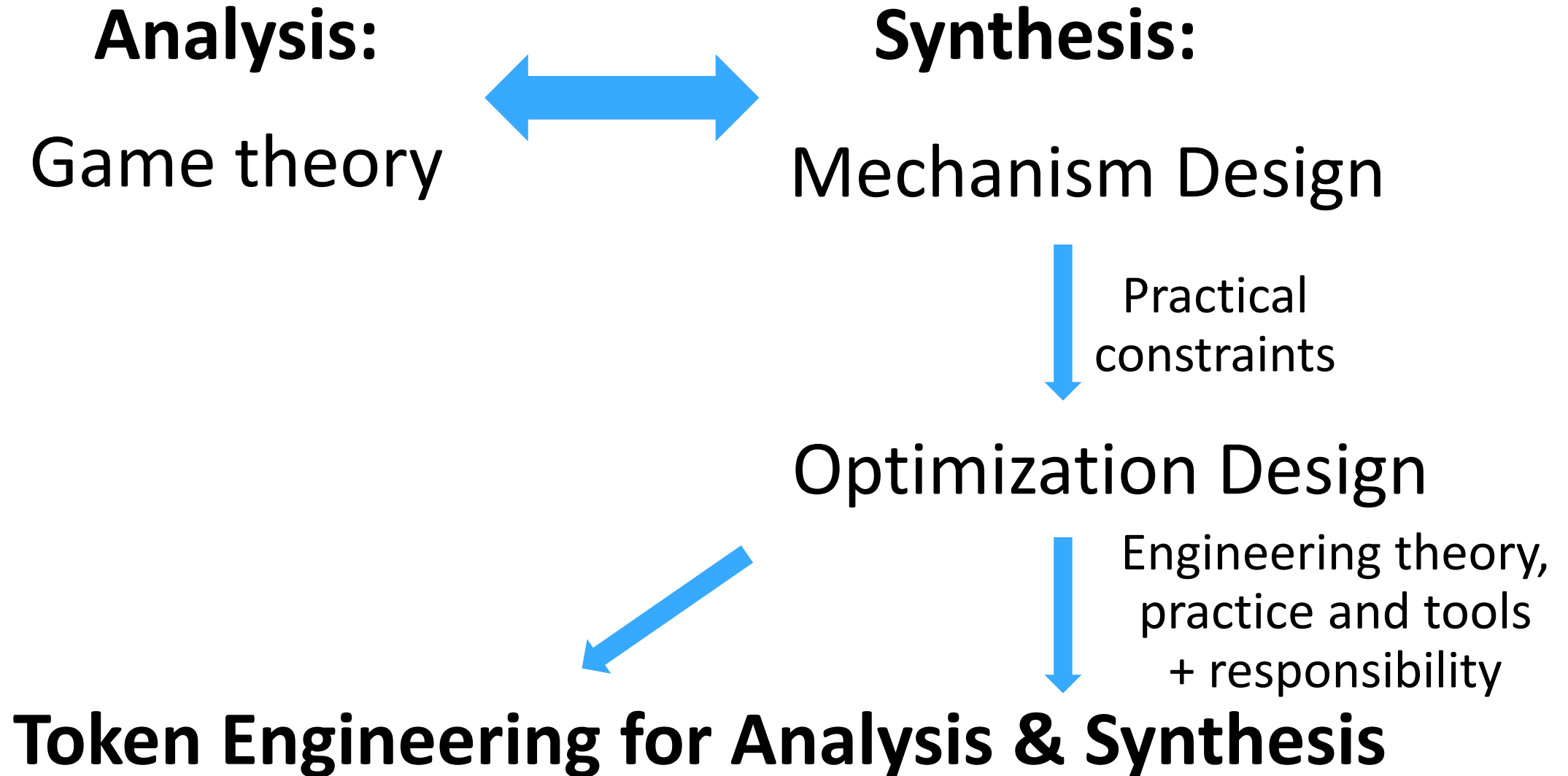
Tools for Tokenized Ecosystems?

- **Simulation?** _____
- **Verification?** _____
- **Design?** _____
- **We have tokenized ecosystems to design, \$1B at stake**
- **are designing tokenized ecosystems...**
- **Without tools**
- **Which means we might be getting it all wrong! 🤯**

Towards Token *Engineering*

Design of Tokenized Ecosystems

From Mechanism Design to *Token Engineering*



Engineering



is the creative application of science,
mathematical methods, and empirical
evidence

to the innovation, design, construction,
operation and maintenance

of structures, machines, materials, devices,
systems, processes, and organizations.

Engineering Responsibility



Engineering has

Theory,
Practice,
Tools,
Responsibility

Science \leftrightarrow Engineering

- **Engineering** is about building things that work.
- **Science** is about contributing new knowledge.
- They're complementary.

Therefore **token engineering** is complementary to the science of cryptoeconomics / **token economics**.

Towards a Token Engineering *Community*

TE → TE Community

- A pleasant surprise to me: “Token Engineering” resonated with a *lot* of people
- And many new connections for me.
- Many amazing conversations.
- **A collective realization: we need to share knowledge, to learn from each other!**

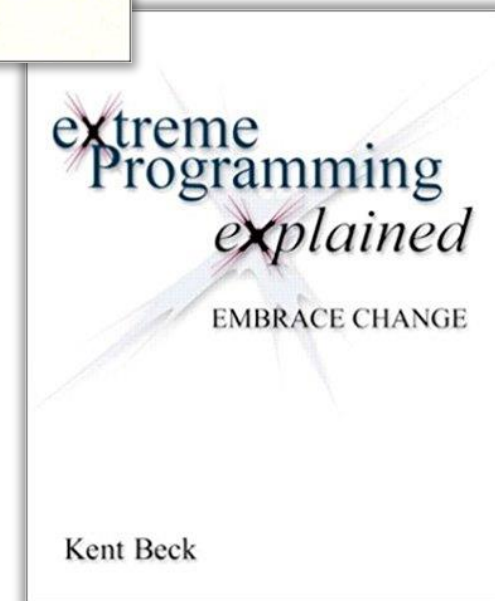
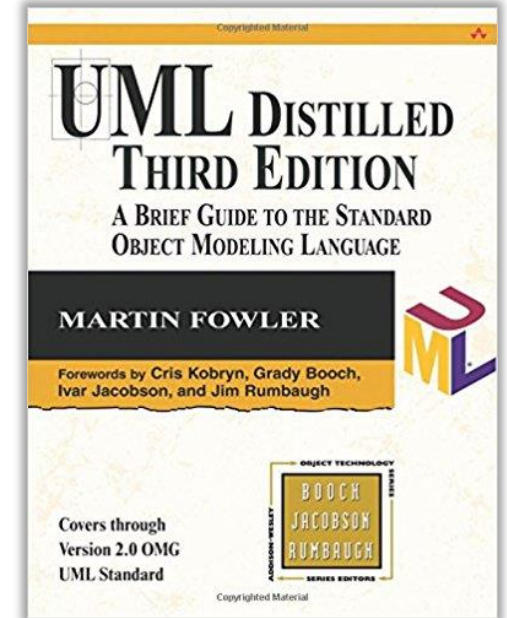
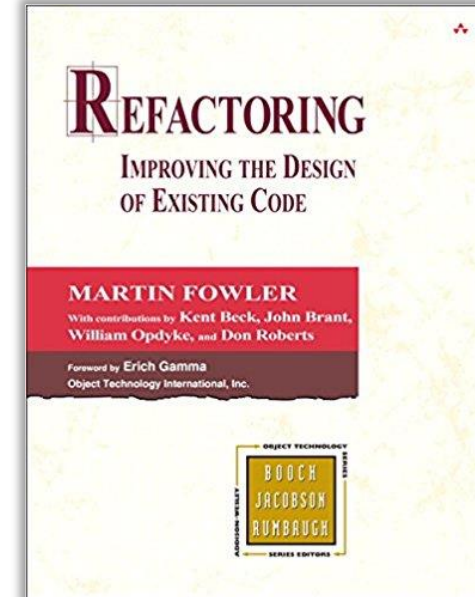
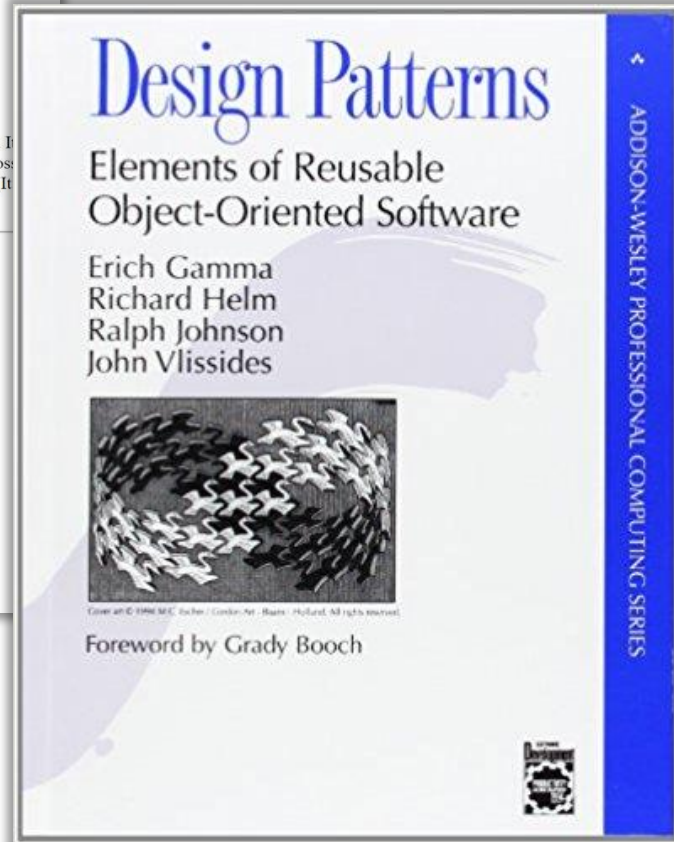
Mission of the TE Community

To grow TE into an **engineering discipline**

collectively as a community

in a decentralized, permissionless, open-source fashion that all can contribute to and all can use.

An inspiration: evolution of software engineering. C2 wiki → ✨



A Wiki for TE: tokenengineering.net

The screenshot shows a web browser window with the address bar displaying 'tokenengineering.net'. The page title is '#TokenEngineering Wiki'. The Wikidot logo is visible in the top left. A navigation bar includes links for 'main', 'discuss', 'edit this page', 'view source', 'history', and 'other tools'. The main content area features a large 'TE' logo on the left and a 'Contents' section with links to 'Building Blocks', 'Tools', 'Reading Resources', and 'Community'. Below this is an 'About' section with a welcome message and a 'The Challenge' section discussing the difficulty of creating tokenized ecosystems.

#TokenEngineering Wiki

Expert tip #2: Learn the Wikidot syntax - it's simple but powerful

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TE

navigation

- [Main page](#)
- [Contents](#)
- [Featured content](#)
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search

#TokenEngineering Wiki

Contents

- [Building Blocks](#) : Cryptoeconomic Primitives and Higher-Level Patterns
- [Tools](#) : Simulation, Design, Verification, etc. Related projects.
- [Reading Resources](#) : Learn more!
- [Community](#) : Events, related communities, more.

About

Welcome to the Token Engineering (TE) wiki & community! **Please join in and contribute:)** Simply [sign up](#) then click 'e

The Challenge

Creating tokenized ecosystems is *hard*. How do we figure out what we want? How do we manifest that intent with block and validate the design? How do we anticipate attacks and respond to them? How do we update the protocols? Given t

Building Blocks

Building Blocks : Cryptoeconomic Primitives and Higher-Level

Types of blocks (highest level) (one framing)

- [Proofs](#) of human or machine work
- [Curation](#)
- [Identity](#)
- [Micro-Economical](#): DAOs, Stablecoins, etc
- [Consensus](#): Voting, staking, etc
- [Reputation](#)
- [Governance](#) / software updates
- [Third-party arbitration](#)
- [Inter-operability](#)
- «add to me! revise me! :)»

Other Framings

Other ways to frame or group building blocks include: «FIXME: add links to these. The

- How tokens are distributed. This includes releasing coins for “work”, according to a more.
- Ethereum token standards, such as [ERC20 fungible token](#) and [ERC721 non-fungible](#)
- How tokens are valued. As a means of exchange, store of value, and unit of account

Navigation

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Toolbox

Tools

Tools : Simulation, Design, Verification, etc. Related projects

Tools for Simulation & Verification

- [Incentivai](#) – test smart contract mechanism design via simulation using AI agents
- Related: there's lots of work on formal verification of smart contracts. That covers straight up what a token simulator could do.
- Related: circuit simulators like SPICE which simulate dynamical systems
- Related: dynamical systems simulators in other fields
- Related: agent-based simulators in other fields
- «add to me»

Tools for Design

- Related: computer-aided design (CAD) tools in other fields. E.g. in the Electronic Design Automation
- «add to me»

Other Related Projects

- [BlockScience](#) – a technology research and analytics firm specializing in the design and evaluation of blockchain-based systems
- [Policy Design Lab](#) - «FIXME: what is this»

Reading Resources

Related Disciplines

- [Mechanism Design](#)
- [Algorithmic Game Theory](#)
- [Economic Systems Design](#)
- [Game Mechanics Design](#)
- [Systems Engineering](#)
- [Public Policy Analysis & Design](#)
- [Swarm Robotics](#)
- [Operations Research](#)

Reading Resources

- Alex Evans, [A Crash Course in Mechanism Design for Cryptoeconomic Applications](#), Oct 2017
- Trent McConaghy, Towards a Practice of Token Engineering [Part I](#), [Part II](#), [Part III](#), Feb 2018
- Michael Zargham, On Engineering Economic Systems [Part I](#), [Part II](#), Mar 2018
- Elad Verbin, [Behavioral Crypto-Economics: The Challenge and Promise of Blockchain Incentive Design](#), Mar 2018
- Jacob Horne, [The Emergence of Cryptoeconomic Primitives](#)
- Chris Burniske, [The Crypto J-Curve](#), Aug 2017
- Chris Burniske, [Cryptoasset Valuations](#), Sept 2017
- Adrian Colyer, [Designing Secure Ethereum Smart Contracts - a Finite State Machine Approach](#), Mar 2018
- «add to me» «and start to group these more:) »

Community

Community: Events, Related Communities, more.

Upcoming Events

- Sun May 13, 2018 - NYC. Approx 12pm-6pm. This is the day before Co at [TE NYC meetup page](#)
- «your event?»

TE Meetup Groups

(The actual meetup.com pages will typically have the most up-to-date info)

- [Meetup: TE Berlin](#)
- [Meetup: TE NYC](#)
- [Meetup: TE Toronto](#)

Wanna start your own TE meetup? Please do! :) :) You can link to it here. I

Related Communities

- Cryptoeconomics Hub. [Madrid meetup](#), [YouTube Channel](#)
- Curation markets chat channel <link needed!>
- «Add to me»

Ways to Participate

- Edit this wiki and impart your wisdom! Add blocks, tools, readings.
- Tweet with #tokenengineering hashtag
- Attend a meetup (see [Events](#)). Or: start your own!
- Subscribe to the TE mailing list:

Email Address

Subscribe

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[Angela Kreitenweis](#)
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 [Or Luis Shemtov](#)
 [bmann](#)
 ;-)

Conclusion

Towards a #TokenEngineering Community

- **Token Engineering** = Theory + practice + tools + responsibility in the creation of tokenized ecosystems.
- One framing: like an EA. We'll see other approaches today.
- **TE is a field we can all create together. Now is the time to start:)**

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